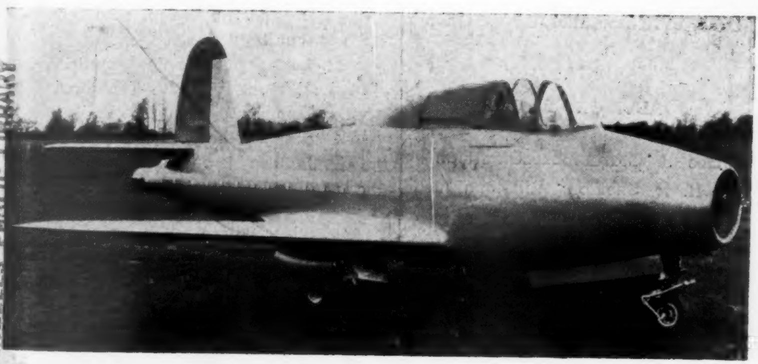
ASTRONAUTICS

Journal of the American Rocket Society

Number 60 **December, 1944**

—U. S. Air Forces

AMERICAN AIRACOMET — Bell Aircrafts P-59A propellerless plane showing the right thermal jet engine.



—British Information Services

BRITISH GLOSTER—New R.A.F. jet-propelled plane which has been used with success against robot bombs.

NOTES AND NEWS

The February 19, 1944 issue of The Academy News announces that The Rocket Society of The American Academy of Sciences, Savannah, Ga., is probably the oldest in the world, being founded in 1918 by Dr. Matho Mietk-Liuba. Interested in rocket research since 1915, Dr. Liuba on July 10, 1929 created the "New York Experimental Station", a one-man affair, which in 1937 merged into The American Academy of Sciences. The Rocket, official publication of The Rocket Society, appears in The Academy News.

Col. Donald J. Keirn of the Power Plant Laboratory, Wright Field, Dayton, Ohio, was recently given The Thurman H. Bane Award for 1944, by the Institute of the Aeronautical Sciences, for "His contribution to the development and utilization of the new jet propulsion engine." Colonel Keirn, who received the annually presented award for the most important technical contribution at the Wright Field Air Technical Service Command, went to England in 1941 to study the British jet plane. In 1943, through his efforts and leadership, a new jet propulsion engine was designed and flown successfully.

The Bristol Aeroplane Co., England, has announced that the giant postwar Brabazon airliner will be jet-propelled. This Queen Mary of the air is expected to only need 15 hours to cover the transatlantic route of London-Montreal-New York.

American and British Jet Planes

A DESCRIPTION OF THE BELL AIRACOMET

Termed the most important development in aviation since the Wright brothers flew at Kitty Hawk forty-one years ago, the jet plane although revolutionary in design is well on its way to perfection. The most noticeable characteristics of thermal jet-propelled aircraft are the absence of propellers, single or twin air-intake ducts, thermal jet installations when housed externally, trim streamline appearance, laminar flow tapered wings, high upswept tail, reduced landing gear and tail-pipe nozzle. Propellerless planes have a fast rate of climb, can fly at greater speeds owing to elimination of propeller compressibility and less drag, and can operate in thin air high above the ceilings of conventional engined planes. Due to lower air resistance less fuel is consumed at high altitudes than at low altitudes when traveling at the same speed. One source considers a jet engine at 100 m.p.h. over a 400 mile flight requires 70 gallons of fuel to an internal combustion engine's 16 gallons; while covering the same distance at 600 m.p.h., the gasoline engine consumes 850 gallons, the jet engine only 770 gallons.

The Army Air Force's Bell P-59A Airacomet is powered by twin gas turbine jet engines developed by General Electric engineers from the British Whittle invention. The simply constructed jet engines, which snugly hug either side of the fuselage under the wing roots, are lighter than regular gasoline engines, will run on either kerosene or gasoline, and need only 30 seconds to warm up.

A small electric starting motor, driven by an outside source of power or batteries in the plane, starts the high-speed rotary compressor. Air entering the front duct is forced by the compressor into the combustion chamber where it is mixed and burned with the fuel. Part of the hot compressed gases operate a turbine which is connected by a shaft to the compressor. The gases then exhaust through a tail-pipe nozzle giving a forward drive to the plane. When the jet unit is running smoothly the starting motor is automatically cut off.

In flight no tell-tale smoke or flame leaves the jet nozzle and only a dull roar is heard. Having only one throttle and a single instrument panel the plane is easy to fly, and so smooth is its flight due to exclusive use of rotating parts that a special vibrator is necessary to eliminate the stickiness of instrument needles. Radio interference from sparking plugs is minimized as continuous ignition is not required. The jet unit is easily overhauled and as the tricycle landing gear is short all repair work is simplified.

Little information is available on the British jet-propelled Gloster, other than that given on the Whittle patent in past columns of ASTRONAUTICS. A side view of the plane reveals it has a central intake vent in the nose of the plane and a tail nozzle, similar to Italy's famous Caproni-Campini CC2 which flew from Milan to Rome in November, 1941. The British plane is reported to have been in action against robot bombs with good results.

The Nazi V-Weapons

Long Range Rockets Now In Use

By Cedric Giles

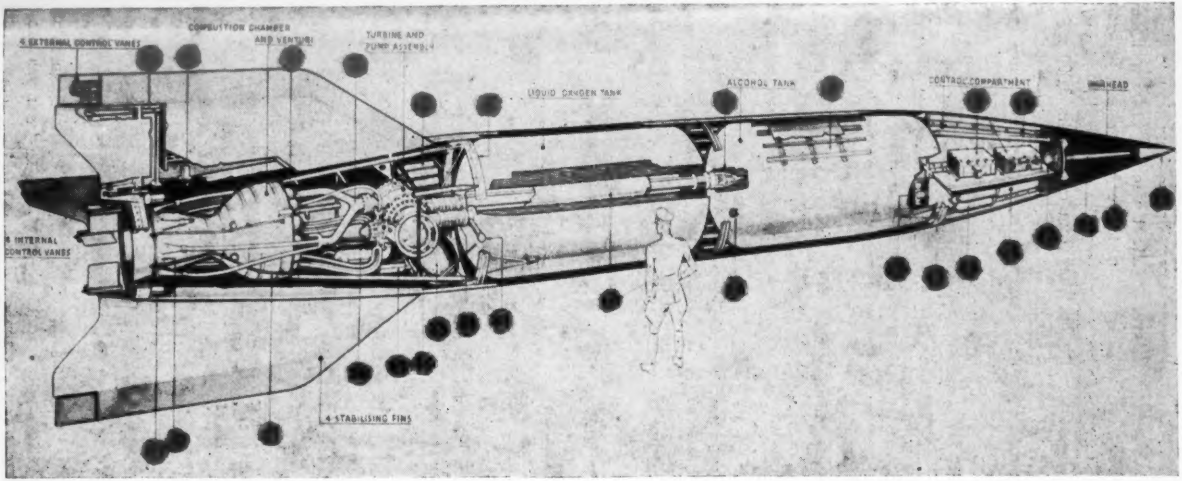
The British government initially learned in the early months of 1943 of long range jet-propelled weapons being developed by the Germans to bombard London. A special committee was formed which by July through investigations by agents and air reconnaissance had located the main experimental stations for the robots and long range rockets at Peenemunde, on the Baltic coast. Bomber raids against the installations in mid-August succeeded in causing severe damage to the stations and killed a number of German rocket experimenters, including the head scientist. These and later raids on the launching sites in the Havre-Calais area and on war production plants and factories delayed the German attack program for many months. With the larger launching platforms destroyed, smaller prefabricated structures were developed which could be assembled rapidly and easily camouflaged.

Following the appearance of the first German V-1 robot bomb on the night of June 13, 1944, the bombardment of southern England, especially London, by this formidable weapon continued night and day. Defensive measures against some 10,000 robot bombs launched at England included interceptor planes, anti-aircraft armament with many of the rocket gun type, and barrage balloons. The capture of the launching sites in France by the advancing Allied armies greatly curtailed flying bomb operation.

The V-2

During the past few months reports from Holland, Sweden and England expressed belief that the Germans were rushing experiments on huge rockets capable of flying through the stratosphere. The device was touted by the German commentators as the secret weapon most likely to win the war. While Switzerland told of reverberations coming from the German shores of Lake Constance, great explosions on the French coast were attributed to large rockets blowing up while taking-off from launching platforms. (ASTRONAUTICS No. 57). Drawings of various types of launching stands have been published and pictures have lately appeared showing sectional views of damaged parts of large rockets. Recently, long range rocket projectiles, known as V-2, have been directed at London, and to a lesser degree at Paris and the port of Antwerp.

The standard V-2 rocket is reported to have an overall length of 46 feet with a 5½ ft. diameter. Takeoff weight is approximately 13½ tons, consisting of one ton explosive in the warhead, two large tanks holding 7,500 lbs. of high octane alcohol and 11,000 lbs. of liquid oxygen, and the rest rocket shell and equipment. A turbine, driven by superheated steam produced by mixing concentrated hydrogen peroxide and a calcium permanganate solution, operates pumps which force-feed the liquid oxygen and alcohol into the combustion chamber where the mixture is initially electrically ignited by remote control. The gaseous products of combustion exhausting at high speed through the nozzle give a thrust of about 26 tons, or twice the rocket's weight.



Key to Diagram

1. Chain drive to external control vanes.
2. Electric motor.
3. Burner cups.
4. Alcohol supply from pump.
5. Air bottles.
6. Rear joint ring and strong point for transport.
7. Servo-operated alcohol outlet valve.
8. Rocket shell construction.
9. Radio equipment.
10. Pipe leading from alcohol tank to warhead.
11. Nose probably fitted with nose switch, or other device for operating warhead fuse.
12. Conduit carrying wires to nose of warhead.
13. Central exploder tube.
14. Electric fuse for warhead.
15. Plywood frame.
16. Nitrogen bottles.
17. Front joint ring and strong point for transport.
18. Pitch and azimuth gyros.
19. Alcohol filling point.
20. Double walled alcohol delivery pipe to pump.
21. Oxygen filling point.
22. Concertina connections.
23. Hydrogen peroxide tank.
24. Tubular frame holding turbine and pump assembly.
25. Permanganate tank (gas generator unit behind this tank).
26. Oxygen distributor from pump.
27. Alcohol pipes for subsidiary cooling.
28. Alcohol inlet to double wall.
29. Electro-hydraulic servo motors.

According to disclosures the V-2 is launched vertically at a one gravity velocity from steel and concrete platforms the size of a tennis court situated in the Netherlands and on the German border. To combat the high heat generated during early launching operations constant jet spraying of ice-cold water was required to prevent the ramp from warping and bending out of shape. The range is determined by the fuel supply being automatically cut off by radio control or pre-set instruments after a minute of flight, when the projectile through gyroscopic control of external flight vanes has attained a 45 degree angle.

Going up to a 60 or 70 mile altitude, in the zone where meteors first become visible, the rocket has a trajectory of over 200 miles in the five minutes of flight. Estimations based on the velocity of the rocket fall and the temperature of the shattered pieces place the speed of the V-2 while near the earth faster than that of sound (about 700 m.p.h.) and as much as 3,000 m.p.h. in the stratosphere. Some of the earlier V-2's were said to be void of wings and fins and considered "spinners" in that tangentially ejection of the exhaust gases through special jets stabilized the rocket by rotating it. More recent rockets have four large external stabilizing fins at the tail.

At the present, the high speed and trajectory of the rocket make accuracy virtually impossible, with the longer the range the greater possible error in hitting the selected target. Consideration must be taken of such factors as variations of exhaust velocity, atmospheric density, atmospheric temperature, direction and velocity of wind encountered at different stages, weight changes of the projectile, and even rotation of the earth. And many of these factors change from day to day.

More efficient use of present fuels will give a longer range but it appears unlikely the United States will be bombed from across the 3,000 mile Atlantic unless the range of the V-3, the transatlantic rocket, is vastly increased over the V-2 by using a new fuel with greater heat content per pound. Employing a step-rocket which discards the fuel containers when empty would greatly assist in increasing the present V-2 range. Launching robot bombs from surface craft or from special retractable platforms on the decks of submarines 50 or 100 miles offshore seems the most feasible method.

U. S. Robots

The U. S. Army Air Force has disclosed that a version of the German V-1 robot bomb has been reproduced and test flown. Sections of badly-battered robots flown from England on July 9, were studied and a reconstructed exact model was aerodynamically tested in a wind tunnel for nearly a week.

On October 11 the first American flying bomb was jet-propelled through the air in a test flight. The United States is at present producing for experimental purposes a few thousand one ton robot bombs 27 ft. long and 33 in. in diameter with a 17 ft. wingspread. Wherein the German robot needed a velocity of over 100 m.p.h. before the duct engine functioned properly, the American counterpart can start at lower speeds and does not require an elaborate launching platform. Starting electrically the robots attain 600 m.p.h. speeds and are reported to be under directional control at all times. Following the experimental stage the weapon is to be mass produced.

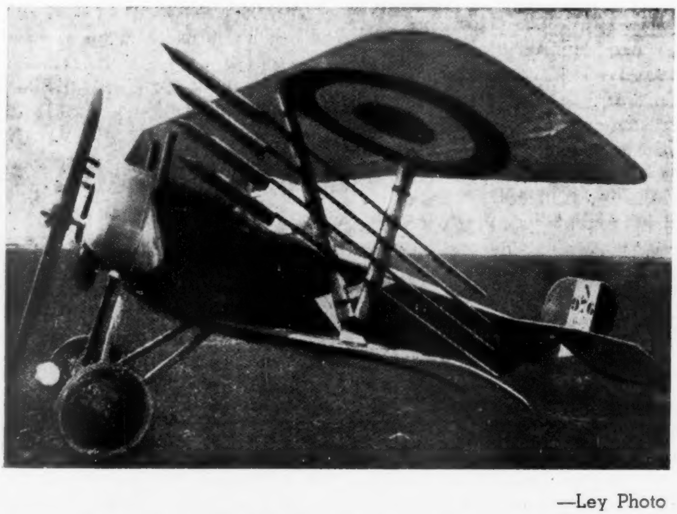
ROCKET FIRING BIPLANES

The forerunners of the rocket discharging planes of the present war were the biplanes of the British, French and Russian aviators which fired jet propelled incendiary projectiles at German captive observation balloons and Zeppelins in World War I. An incendiary missile on piercing the skin of an inflammable hydrogen-filled gasbag was usually sufficient to set it afire. A number of these kite balloons were sent down in flames although it is doubtful if any Zeppelins suffered the same fate.

In addition to the usual single machine gun mounted over the cockpit the armament consisted of large size powder skyrockets attached by their guiding sticks to wing struts or carried in tubes and electrically ignited by the pilot. The rockets were generally mounted in groups of four one above the other on either side of the fuselage. The efficacy of the weapon was poor as the rockets had a low velocity and a range of only several hundred feet.

Lieutenant Y. P. G. Le Prieur, a French naval officer, is credited with suggesting the idea and the rockets usually bore his name. The Nieuport Scout carrying 8 Le Prieur rockets appeared the most popular in this type of warfare. Other planes included the French Fuseen fitted with 8 rockets and the Henry Farman with 8 or 10. Vickers, Inc., is also credited with having designed fighter planes equipped with incendiary rocket projectiles.

Little official information was released on rocket armament other than the episode in the spring of 1916, when the flaming rockets of a group of Nieuports set ablaze four enemy balloons.



—Ley Photo

French Fuseen Biplane Fitted With Eight Le Prieur Rockets

Rockets and Pseudo-Rockets

Some Interesting Comments On Airstream Engines

By Laurence Manning

While technically not true rockets, the Robot-bomb and the Jet-plane have seized on popular imagination as types of rockets and their technic seems to include so much similar matter to rocket technic that unquestionably the ARS can help in their development. And we certainly should, for they promise to solve to a large extent one of the least considered problems in rockets—how to get a liquid-fuel rocket up through the heavy lower atmosphere where it is relatively inefficient?

Mr. Manning, a former editor and writer for ASTRONAUTICS, some years ago made a detailed research in the possible methods of reaching the speed of liberation from the earth and concluded the only possibility for interplanetary flight is the rocket.

How simple in design would be a jet plane that draws in atmosphere for combustion until the upper stratosphere is reached, whereupon it draws instead on its oxygen tanks. Compare it to the elaborate suggestions of only a few years ago to start a space-rocket on a long inclined runway under ground-power until takeoff; or even to Dr. Goddard's exhaust stream turbine (though the published patent drawings of this are merely schematic and the complete design doubtless more practical). Instead of such untried devices, it will be possible merely to add oxygen tanks to a proved and working jet-plane. This at once makes practical flight experiments of liquid-fuel rockets simple—in fact, inevitable—in the near future.

True, such immediate experiments will not be sensational moon-voyages. All the better. They can proceed step-by-step, a little at a time, until the possibilities are safely understood and charted. No other method is more likely to result in precise scientific truth. Flight tests of large rocket motors become at once both more hopeful and more likely to be undertaken soon.

Moreover, the saving in weight would be considerable since the first ten or twelve miles of vertical flight would be with atmospheric oxygen. It might cut the liquid oxygen requirements as much as 25%. Such a reduction, even when offset by the weight of blowers and turbine, would make a relatively large advantage in figuring altitude possibilities. But that is not all: Air resistance in the first 10 miles of atmosphere is so great only hope of economic rocket flight depends on high speeds. The advantage of using relatively low speeds until extreme jet-plane altitude is reached and only then, in the rarer upper atmosphere, commencing high-speed true rocket flight cannot be underestimated. The combined saving of weight and of lessened air resistance is, in my opinion, the most hopeful line of rocket development since Wyld's regenerative motor was invented.

Pseudo-Rocket Motors.

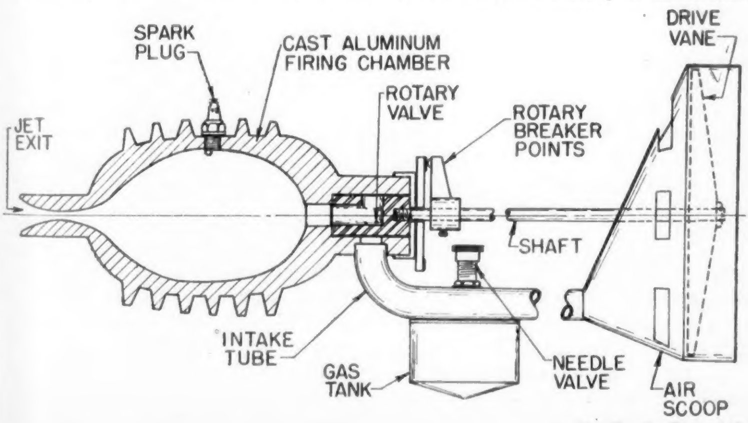
There are two main types of jet propulsion devices: The turbine and the

air-ram. The air-ram, as used in the German robot bomb, is extremely simple. In the nose of the plane (or robot "bomb") is an air scoop which funnels and compresses the air on impact with the nose of the ship into a tube. This tube leads through a valve to the firing chamber where it sucks in gasoline as it enters, burns, and (greatly expanded by the heat and combustion) rushes out an exhaust nozzle. The reaction from this exhaust drives the ship forward. The valve is vital, since without it the exhaust in many cases would be as likely to go forward as backward and there would be no driving force at all. Yet it can be simple: A rotating connecting-tube, which is driven by an air vane in the mouth of the air scoop, and which once each revolution connects the intake air tube with the firing chamber. When open it permits air to enter with induced gasoline. As it closes a spark plug ignites the mixture in the firing chamber which immediately exhausts. The chamber is empty again by the time the rotary valve makes its next revolution. So great is the speed of such intermittent explosions that they give a practically continuous thrust.

The second, or turbine type, as used in British and American types of jet-planes, is essentially a supercharger placed near the nose of a plane, feeding air into a firing chamber through a relatively small tube. Here it mixes with gasoline (or other fuel) and discharges through a larger tube ending in a conventional exhaust nozzle. Prior to reaching the nozzle, the flow of exhaust gases meets and drives a turbine rotor which is keyed on the same shaft as the air compressor. In this design a material amount of the power created is first used to compress more air into the chamber against pressure, but the substantial residue is sufficient to allow planes to operate at very high speeds.

Motors For Model Airplanes

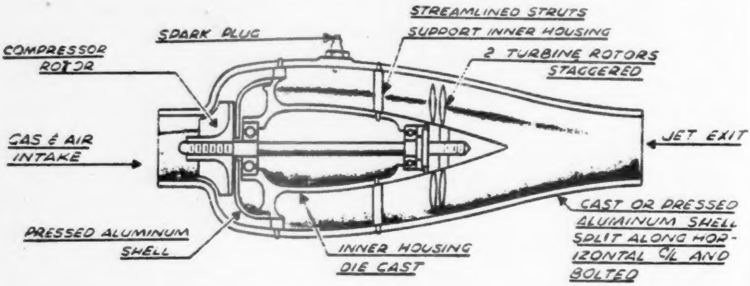
Both types of propulsion devices are so simple in general design that they lend themselves readily to small-scale



—Air Trails Pictorial

An intermittent jet propulsion unit having an air vane, rotary valve and combustion chamber.

experiment model engines suitable to use in model airplanes. The magazine "Air Trails Pictorial" (May and June 1944 issues) suggested some interesting designs worth the attention of members interested. Two schematic designs of jet-propulsion motors suitable to such experimental work are shown here. They are purposefully kept simple, since the primary object of this resume is to encourage experiment. Even under war restrictions, it is possible to work on such a small scale as is here suggested.



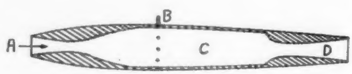
—Air Trails Pictorial

A continuous power unit employing an air compressor and two turbine rotors.

The Athodyd

The simplest of the thermal jet propulsion duct engines is the athodyd—a contraction of the term: aero thermodynamic duct. In 1913, the French inventor Lorin conceived a constant pressure combustion system with a continuous operation of air intake, compression, combustion and power jet. The athodyd scheme called for a venturi-shaped tube, containing no moving parts, and equipped with only fuel injectors and a sparking plug for starting purposes.

The athodyd, to operate at all, must be moving through the air at high velocity. Due to the forward speed, atmospheric air rammed into the divergent entrance is compressed by the following air. As the compressed air expands in the combustion chamber, fuel is injected, and the mixture burns continuously. The hot gases on leaving the combustor discharge through a nozzle at high velocity pushing the athodyd forward by reaction.



A Lorin Thermal Jet Unit

A—air inlet
B—fuel injectors
C—combustion chamber
D—diffusor

General Electric engineers recently tested an athodyd in a 290 m.p.h. wind tunnel. After being initially started by the spark plug, the athodyd moved forward against the wind demonstrating the feasibility of the principle. With apparently no speed limit, the athodyd achieves better efficiency the faster it travels.

Jet Assisted Takeoff

ARMY AND NAVY USING JET BOOSTERS

For some time the Army and Navy have been using jet propulsion devices to assist aircraft to take off with heavier loads, shorter runs and greater speeds. Besides a larger element of safety, the jet unit through a burst of extra power permits a high angle takeoff, removes the takeoff strain on the conventional engine, and saves some portion of the fuel. Efficient use of rocket power reduces the necessity of specially constructed air bases having exceptionally long runways. For satisfactory performance the takeoff unit should operate until the aircraft is safely airborne.

Externally attached to the plane, the jet unit looks very much like a bomb. Comprising of a cylinder loaded with a solid propellant containing the necessary oxygen, the need for atmospheric air is thus eliminated. An electrically controlled spark plug ignites the propellant which expands as a gas and exhausting through the nozzle opening gives a forward thrust to the plane. More than one takeoff unit is being used at the present time on a single plane, with presumably future improvements requiring permanent attachments ready to accommodate two, four or six units.

The Army Air Force, after experimenting since 1940, has developed for its planes two types of jet units, the fixed and the droppable. Attack and planes of similar type have fixed units fastened to the fuselage in such a manner that the gaseous flame will avoid the empennage. Bombers and other heavy planes have the jettison units attached on the underside of the wings. When empty, the cylinder is so arranged that at the will of the pilot it may be dropped by parachute and reused. The additional weight and air resistance of the jet unit is consequently eliminated.

The Navy jet assisted takeoff units, known as "Jatos", develop a thrust equivalent to 330 h.p. during takeoff operation, with the possibility of doubling this horsepower in the near future. The length of takeoff runs of naval planes have already been reduced from 33 to 60 per cent. Carrier-based fighters when using the units only require half as much takeoff space as normally, permitting the carrier to have more available storage space for planes. Speedier rising from the carrier means more planes aloft in a shorter time ready to attack the enemy or defend the flat-top and accompanying surface craft. A reduced run will permit larger aircraft to operate from flight decks of baby carriers or convoy vessels.

Flying boats can shorten their takeoff run, thereby diminishing their main impediment, or are enabled to carry a greater load. The booster units will be ready and proven when the time comes for applying them to cargo planes and transports.

Retarding jet units, designed to exhaust forward thus acting as a brake, would slow the aircraft and cut the landing run. This necessitates a rocket unit design in which all adjacent surfaces are protected to minimize the danger of fire.

THE ROCKET SOCIETIES

Amateur Research Society, Clifton, N. J. Founded 1937. First President, Nicholas Swerduk.

American Institute for Rocket Research, Chicago, Ill. Founded 1936, by C. W. McNash. First President, C. W. McNash.

American Rocket Society (formerly American Interplanetary Society), 130 West 42nd St., New York City. Founded 1930, by Warren Fitzgerald, David Lasser, William Lemkin, Everett Long, Laurence E. Manning, C. P. Mason, G. Edward Pendray, Fletcher Pratt, Nathan Schachner, and C. W. Van Devander. First President, David Lasser; Present President, James H. Wyld.

Bulletin, Nos. 1-18 (June 1930 - April 1932). **Astronautics**, Nos. 19 - 60 (May 1932 - Dec. 1944).

Astronautical Development Society, Surrey, England. Founded 1938, by K. W. Gatland and H. N. Pantlin.

Spacecraft, Dec. 1941.

Spacewards, Vol. 4-5 (Oct. 1942 - April 1944). 7 issues.

Bulletin, Vol. 4-5 (Mar. 1942 - Feb. 1944). 24 issues.

Australian Rocket Society, Brisbane, Australia. Founded 1936, by Alan H. Young and Noel S. Morrison. First President, Alan H. Young.

Australian Rocket Society, 219 High St., Prahran, Melbourne, Australia. Founded 1941, by J. A. Georges. First President, J. A. Georges; Present President, same.

British Interplanetary Society, London, England. Founded 1933, by P. E. Cleator. First President, P. E. Cleator.

Journal, Vols. 1-5 (Jan. 1934 - July 1939). 12 issues.

Bulletin, Vols. 1-3 (Oct. 1934 - Aug. 1939). 29 issues.

California Rocket Society, 1764 Garth Ave., Los Angeles 35, Calif. Founded 1940, by Bernard Smith. First President, Bernard Smith; Present President, same.

Cleveland Rocket Society, Cleveland, Ohio. Founded 1933, by Edward L. Hanna and Ernst Loebell. First Chief Engineer, Ernst Loebell.

Space, Vol. 1 (July 1934-). 4 issues.

Combined British Astronautical Societies, Northern Headquarters, 2 Hillview Road, Denton, Manchester, England. Founded 1944, by the A.D.S. and the M.A.A. First President, E. Burgess; Present President, E. Burgess.

Spacewards, Vol. 5-6 (July-Oct. 1944). 2 issues.

Bulletin, Vol. 6 (Mar.-Aug. 1944). 6 issues.

Fortschrittliche Verkehrstechnik e.V. (Interplanetary Society of Germany), Berlin. Reorganized 1933, by Willy Ley and Dr. Otto Steinitz. First President, Major Hanns Wolf von Dickhuth-Harrach.

Das Neue Fahrzeug, Vol. 1- (Feb. 1933-1937). 20 issues.

GALCIT Rocket Research Project, California Institute of Technology, Pasadena, Calif. Founded 1936, by Weld Arnold, Edward S. Forman, Frank J. Malina, John W. Parsons, A. M. O. Smith, and Hsue-Shen Tsien. First Chairman, Dr. Th. von Karman.

Research Papers, R1 - R-7.

Gesellschaft fur Weltraumforschung e.V. (Society for Space Investigation), Breslau, Germany. Founded 1938, by Hans K. Kaiser. First Sec., Hans K Kaiser.

Astronomische Rundschau (Astronomical Survey), Nos. 1-4 (Jan. 1938-Dec. 1938).

Weltram (Space), Nos. 1-4 (Jan. 1939 Dec. 1939).

Glendale Rocket Society (formerly Southern California Rocket Society), 3262 Castera Ave., Glendale 8, Calif. Founded 1943, by George James. First President, George James; Present President, John Cipperly.

Bulletin. Nos. 1-7 (Aug. 1943 - Feb. Mar., 1944).

Indian Air Mail Society. Calcutta, India. Present Sec., Stephen H. Smith.

Quarterly Bulletin.

Len-GIRD (Group for the Study of Reactive Motion), Leningrad, Russia. Founded 1929, by Prof. Nikolai Rynin and Dr. Jakow I. Perlmann.

Manchester Astronautical Association. 2 Hillview Road, Denton, Manchester, England. Founded 1937, by E. Burgess and T. Cusack. First President, E. Burgess.

Spacewards. Vol. 1-5 (Aug. 1939 - April 1944). 19 issues.

Bulletin. Vol. 1-5 (1938 - Feb. 1944).

Manchester Interplanetary Society. Manchester, England. Founded 1936, by E. Burgess. First President, E. Burgess.

Astronaut. Vol. 1-2 (Apr. 1937 - Aug. 1938). 6 issues.

M.I.T. Rocket Club. Massachusetts Institute of Technology, Cambridge, Mass. Founded 1941.

M.I.T. Rocket Research Society. Massachusetts Institute of Technology, Cambridge 39, Mass. Founded 1940, by George Burdick and Robert Youngquist. First President, Robert Youngquist; Present President, John C. Cook.

Papers on Rocketry. Publications 1-4.

Mos-GIRD (Group for the Study of Reactive Motion), Moscow, Russia. Founded 1929, by Ing. Ivan Petrovich Fortikov.

Nederlandse Rakettenbouw (Dutch Rocket Society), s'Gravenhage, Holland. Founded 1934, by Mijnheer Gerard A. G. Thoolen.

Oesterreichische Gesellschaft fur Raketentechnik (Austrian Society for Rocket Technology), Vienna, Austria. Founded 1931, by Rudolf Zwerina and Count Guido von Pirquet. First President, Ing. Rudolf Zwerina.

Paisley Rocketeers Society. Paisley, England. Founded 1936, by John D. Stewart. First President, John D. Stewart.

Peoria Rocket Association. Peoria, Ill. Founded 1934, by Ted S. Cunningham. First President, T. S. Cunningham.

Journal. Nos. 1-4 (Jan.-Apr. 1939).

Rocket Society of the American Academy of Sciences. Savannah, Ga. Founded 1918, by Dr. Matho Mietk-Liuba. First President, Dr. Matho Mietk-Liuba.

The Rocket. No. 1 (Feb. 19, 1944).

United States Rocket Society. Box 29, Glen Ellyn, Ill. Founded 1942, by R. L. Farnsworth. First President, R. L. Farnsworth; Present President, same.

Rocket Flight. No. 6 (Mar. 1943).

Verein fur Raumschiffahrt, e.V. (Society for Space Navigation), Breslau, Germany. Founded 1927, by Max Valier and Johannes Winkler. First President, Johannes Winkler.

Die Rakete. Vol. 1-3 (Jan./June, July 1927 - Nov./Dec. 1929). **30 issues.**

Westchester Rocket Society. Westchester, N. Y. Founded 1936.

Wissenschaftliche Gesellschaft fur Hohenforschung (Scientific Society for Altitude Explorations), Austria. Founded 1926, by Dr. Franz von Hoefft.

Yale Rocket Club. New Haven, Conn. Founded 1935, by Franklin M. Gates. First Chairman, Franklin M. Gates.

Compiled by C. G.

American Rocket Society

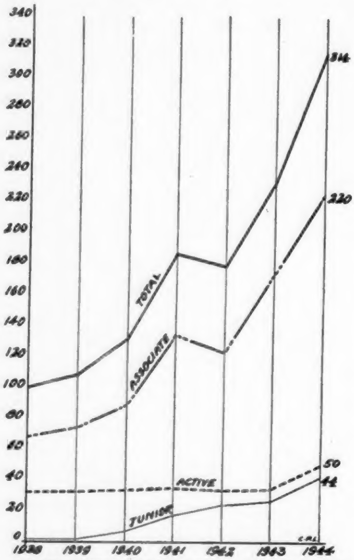
The Journal, Meetings, Directors, Memberships and Finances

The American Rocket Society, formed in 1930, was the largest national rocket society in the world before the war, and had carried on an experimental program, supplementing the activities of its members, which laid the groundwork for many of the jet propulsion devices which have proved of such importance in the war period.

During the past two years, because so many of its members were engaged in confidential work for the armed services and were unable to disclose anything regarding their work, the Society suspended its regular monthly meetings, but continued to issue i's quarterly technical publication, ASTRONAUTICS, a pioneer journal in this field and the only publication in the U. S. today wholly devoted to the technical and engineering aspects of jet propulsion.

The Board of Directors consists of the following officers of the Society: president, James H. Wyld, research engineer of Reaction Motors, Inc., of Pompton Plains, N. J.; vice president, Roy Healy, former editor of ASTRONAUTICS, now engaged in a technical capacity with the armed services; secretary, Dr. G. Edward Pendray, assistant to president of Westinghouse Electric & Manufacturing Company; treasurer, Dr. Samuel Lichtenstein, long identified with the Society; editor of ASTRONAUTICS, Cedric Giles, of the New York Telephone Company; and John Shesta, chief engineer of Reaction Motors, Inc.; and Laurence Manning, a pioneer rocket experimenter and one of the founders of the Society.

Immediately following the six months suspension of all activities in 1942, during which membership declined, the membership of the Society began a rapid rate of increase which is still continuing. The accompanying diagram shows the yearly membership at the end of each fiscal year since 1938.



MEMBERSHIPS OF THE AMERICAN ROCKET SOCIETY

The Society during the fiscal year June 1, 1943 - June 1, 1944 utilized each expended $1.00 as follows:

Astronautics	$ .38
Rent	.22
Literature	.15
Stationery	.13
Postage and Insurance	.06
Advertising	.05
Miscellaneous	.01
	$1.00

BRITISH PATENT SPECIFICATIONS

Many of the earlier British patents proposed direct fluid-pressures, usually air, to be ejected as free jets into the surrounding atmosphere or against surfaces for lifting and propelling aircraft. Apparently as an afterthought, a number of specifications on steam devices suggested the use of steam as also having a possible reactive force.

Such patents have not been included in the following list, which comprises the thermal-air type of jet propulsion in which aircraft is propelled by an explosive mixture of fuel and air, and a few patents where steam or powder is employed. The majority of patents obtained after 1938 are classified as confidential and consequently not listed.

No. 392, Boulton, M.P.W., Feb. 5, 1868.

No. 1,763, Macleod, M.C., Jan. 23, 1904.

No. 2,115, Butler, J. W., and Edwards, E., July 19, 1867.

No. 2,680, Hunter, J. M., Aug. 29, 1868.

No. 2,923, David E., Feb. 5, 1902.

No. 3,561, Kerkhove, A. H. van de, and Snyers, T., Aug. 16, 1881.

No. 4,245, Johnson, J. H., Sept. 3, 1883.

No. 7,919, Hofmann, J., April 21, 1894.

No. 8,182, Johnson, J. Y., June 7, 1887.

No. 10,068, Griffiths, T., Aug. 25, 1885.

No. 11,158, Winkler, A., Sept. 19, 1885.

No. 11,905, Skouses, P., June 13, 1907.

No. 12,349, Griffiths, T., and Beddoes, T. H. W., Aug. 7, 1890.

No. 12,716, Canovetti, C., June 1, 1912.

No. 15,977, Battey, S. B., Sept. 6, 1892.

No. 16,886, Hayot, L. A., Aug. 1, 1912.

No. 17,842, Marconnet, G. A., July 29, 1897.

No. 118,123, Harris, H. S., Aug. 16, 1917.

No. 124,736, Morize, O., July 26, 1917.

No. 145,441, Silva, R. R. da, and Maderios e Albuquerque, J. de, Nov. 5, 1918.

No. 157,781, Guaita, A., Nov. 27, 1920.

No. 256,684, Helfenstein, A., May 12, 1925.

No. 291,263, Hallowell, E., Aug. 19, 1927.

No. 347,206, Whittle F., London, England, Jan. 16, 1930.

No. 366,450, Howard, F. A., Elizabeth, N. J., July 30, 1930.

No. 368,564, Schmidt, P., Munich, Germany, April 15, 1931.

No. 374,247, Tiling, R., Osnabruck, Germany, May 22, 1931.

No. 387,617, Cernoch, J., Prague, Czechoslovakia, Sept. 3, 1932.

No. 402,429, Mainguet, H., Paris, France, June 1, 1932.

No. 406,713, Campini, S., Milan, Italy, July 30, 1932.

No. 409,498, Holzwarth, H., Dusseldorf, Germany, March 29, 1933.

No. 413,184, Dornier C., Friedrichshafen, Germany, Nov. 24, 1933.

No. 418,721, Aktiebolaget Milo, Stockholm, Sweden, Feb. 14, 1934.

No. 424,546, Endres, H., Solingen, Germany, April 15, 1934.

No. 425,046, Stenning, G. A., Brighton, England, Sept. 5, 1933.

No. 431,646, Coanda, H., Seine, France, Jan. 8, 1934.

No. 439,805, Leduc, R., Seine-et-Oise, France, June 6, 1934.

No. 471,368, Whittle, F., London, England, March 4, 1936.

No. 472,850, Tennant, W. J., Stockholm, Sweden, April 21, 1936.

No. 484,405, Fedden, A. H. R. and Owner, F. M., Bristol, England, Nov. 2, 1936.

Compiled by C. G.

BOOK REVIEWS

Rocket Research, by Constantin Paul Lent. Pen-Ink Publishing Company, New York, 1944; 102 pages, $5.00.

A general history and the development of the rocket is presented with excerpts from reports of the early research and experiments of the American Rocket Society. The theory of rocket operation, basic formulas and tables, hot air jet propulsion summary, and the many practical hints should be of great assistance to exponents of the art. Lists of American and British rocket patents and an index are included in the book.

Much of the material in the volume was taken from ASTRONAUTICS, while many of the drawings are presented by the author for the first time.

Spacewards, Official Organ of the Combined British Astronautical Societies. Vol. 6, No. 1, October 1944; 20 pages.

This quarterly has a new style and format, and is now printed. Organization problems are reviewed in the editorial comment and in a Northern Branch meeting report. The technical articles are on absolute motion and the space-ship compass, a reprint of a rocket fuel article from the Dec. 1937 Journal of the British Interplanetary Society, and a mathematical calculation of high altitude rocket trajectories.

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